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ARTICLE I.

DESCRIPTION OF A SKULL OF MEGALONYX LEIDYI, n.sp.

BY JOSUA LINDAHL, PH.D.,
SPRINGFIELD, ILL.

Read before the American Philosophical Society, January 2, 1891.

The specimen to be described on the following pages belongs to Bethany College, Lindsborg, Kansas. It was placed in my hands for description, three years ago, by Prof. J. A. Udden, at that time holding the chair of Natural History in Bethany College, and I wish herewith to express my obligation to the President of the said institution, the Rev. C. A. Svensson, for having allowed me to retain it so long, no less than to Prof. Udden, who first offered me this opportunity, and who, at my request, has communicated a geological sketch of the locality where it was discovered.

This is his letter:

DR. J. LINDAHL, Springfield, Ill. :

Dear Sir :—The fossil skull of *Megalonyx*, which I sent you three years ago, was found by a man in excavating a sand pit near the southwest corner of Harper township, in McPherson county, Kansas.

The watershed between the Kansas and the Arkansas systems runs through McPherson county from east to west. Near the centre of the county it crosses at right angles a shallow trough about ten miles wide, which contains a series of small, undrained basins, and is known by well diggers in the county as the "old river bed." This trough has formerly been one hundred and twenty five feet deeper than it now is, being filled to that extent by sediments burying the red shales into which it is cut. Taken in ascending order, these sediments consist of (1) gravel and sand, containing rolled boulders of clay and angular fragments of cretaceous shales of various sizes up to a weight of a ton and more (*from near the bottom of this gravel the skull was taken*) ; (2) a stratum of clay, observed only in two places, and not known to be continuous over any considerable area ; (3) a stratum of volcanic dust several feet in thickness, seen at six different localities, extending twelve miles in a line across the trough ; (4) a fine dull orange-colored loam, upwards of seventy-five feet in thickness, and occasionally resembling loess.

A. P. S.—VOL. XVII. A.

From the gravel and the sand have been taken the following fossils, determined by Profs. E. D. Cope and R. Ellsworth Call :

Equus major DeKay.

Sphaerium striatum Lam.

Sphaerium sulcatum Lam.

Pisidium abditum Haldeman.

Anodonta, sp.

Valvata tricarinata Say.

Gammarus, sp.

Beds like these are found at various places on the Western plains, but they have suffered greatly by erosion. Their occurrence in McPherson county is at a point marking the crossing of a line of minimum erosion (the watershed) over another line of maximum development (the trough).

A study of the region and the deposits, in my opinion, shows that (1) previous to the deposition of the Pleistocene, the country was traversed by drainage channels considerably deeper than at present ; (2) the time of the making of the gravel and the sand was probably coincident with a period of increasing humidity ; (3) the gravel and the volcanic dust were deposited in waters that did not cover the cretaceous ledges in the vicinity ; (4) floating ice was present as an effective transporting agent, when the sand and gravel were being laid down.

In the gravel, a small boulder was found containing fossils, which have been identified by Mr. E. O. Ulrich as belonging to the Lower Carboniferous. Large boulders are common, consisting of a pure white aggregate of microscopic crystals of carbonate of lime. Specimens of this material have been examined by Mr. George P. Merrill, who says he has seen similar material from the Cretaceous of Texas. Both of these occurrences point to a southern extension of the water in which the deposits were made.

Yours, most sincerely,

J. A. UDDEN.

AUGUSTANA COLLEGE, ROCK ISLAND, ILL., Dec. 10, 1890.

The specimen has not the appearance of having been exposed to violence or to the vicissitudes of long transportation previous to its discovery, its present defects evidently being caused by careless handling afterwards. Prof. Udden had, therefore, good reasons for his hopes that the balance of the skeleton might be found in the same gravel pit. These hopes proved futile, notwithstanding his energetic labors, but he was rewarded by recovering the only missing portion of the right zygoma, and also a dorsal vertebra which may or may not have belonged to the same individual.

The original discoverers of the skull, ignorant of its value, removed both the canine molars, to keep them as curiosities, and, for the same purpose, broke off the protruding ends of five of the other molars, leaving only the 2d in the left maxilla and the 2d and 4th in the right. In this operation they also removed portions of the alveolar walls of the 1st and 5th molars and of the palatine and pterygoid bones (Pl. III). The left canine molar was afterwards returned, though short of its pulp end ; also, the inner half of the piece removed from the 3d right molar. The descending ramus of the left zygoma as well as the intermaxillary bones were not found.

Prof. Joseph Leidy (in his *Memoir of the Extinct Sloth Tribe of North America*, Smithsonian Contributions to Knowledge, Dec., 1853) described two skulls of *Megalonyx jeffersoni* Harlan. One of them, originally belonging to Dr. D. D. Owen's

collection, is now the property of the Indiana State University at Bloomington, Ind. I will here refer to that specimen as the *Owen specimen*. The other, discovered by Dr. M. W. Dickeson, belongs to the Philadelphia Academy of Sciences. I will call it the *Dickeson specimen*. These two skulls and the *Kansas specimen* now before me are, as far as known, the only *Megalonyx* skulls hitherto preserved in any collection. The *Kansas specimen* is specifically distinct from the other two, and has also in other respects a particular value, in so far as it shows the structure of the entire zygomatic arch and of the turbinals, which bones were nearly destroyed in the specimens described by Dr. Leidy. This paper will, therefore, supplement his as a memoir on the genus *Megalonyx*. For easier comparison with Dr. Leidy's figures, the figures illustrating this paper have been drawn, with few exceptions, to the same scale as his. They were executed by my old friend, Mr. A. M. Westergren, for twenty-five years the able artist in the Royal Swedish Academy of Science, in Stockholm, now with Prof. Alexander Agassiz, of Harvard.

Judging from the more perfect obliteration of the sutural connections in the Dickeson specimen, Dr. Leidy has demonstrated that it belonged to an older individual than the Owen specimen. The same argument places the age of the *Kansas specimen* between the other two. The sagittal and occipito-parietal sutures are less open than in the Owen specimen, but more so than in the Dickeson specimen. The temporo-parietal sutures are entirely obliterated, and so is the suture between the basi-occipital and the basi-sphenoidal bones, both of which sutures are distinct in the Owen specimen.

Lateral view.—The obvious difference in the sagittal contour in the three skulls (compare Pl. I with Leidy's Pl. I and Pl. IV) may be explained as owing to difference in age, and would then confirm the conclusion derived from comparing the sutural connections. The still more striking difference in the facial contour in the two specimens of *M. jeffersoni* is most likely a secondary sexual character. May it not be that the males of these animals, like those of the recent cystophorine seals, had some special adaptation of their nose for vocal purposes? The *Kansas specimen* agrees in this contour more closely with the Dickeson specimen than with the Owen specimen; the latter having the nasal vault raised higher than the cranial portion, which is not the case in the other two. It may thus be inferred that these two are females, the Owen specimen a male.

As stated above, but little remains of a *zygomatic arch* in the two specimens of *M. jeffersoni*. A special interest attaches to this arch on account of its extreme diversity of form in the different genera of Edentates. Reinhardt* inferred from the

* Prof. J. Reinhardt: "Kæmpedovendyr-Slægten *Cælodon*," Copenhagen, 1878, pp. 325, 326.

strongly developed sagittal crest and temporal fossa that the zygomatic arch in *Megalonyx* may, not unlikely, prove to be completely closed. Our specimen shows that he was correct in his conclusion. I will here give a detailed description of this structure.

The zygomatic arch.—The zygomatic process of the squamosal bone projects outward and forward, as in *M. jeffersoni*. Its upper border descends first in a *concave* curve for about 8 cm. from the inion (thereby *differing from M. jeffersoni*, in which the corresponding line is *strongly convex*, Leidy, *l.c.*, Pl. I); along the following 4 cm. it deviates less from a horizontal direction; and, finally, in its last 4 cm., it rises gently upward to meet the border of the malar bone, about 15 cm. from its origo on the border of the inion.

The glenoid fossa is curved outward and forward, measuring 5 cm. in length and 2.5 cm. in greatest width. There is but a rudimentary postglenoidal process, but the antero-exterior margin of the fossa is expanded into a horizontally flattened exglenoidal process. The inferior border of the bone extends 4 cm. in advance of this process, and there meets the postero-inferior process of the malar bone. The space between these two processes is more or less roughened.

The external surface of the zygomatic process, viewed from above, is sigmoid; but between its upper and lower margins it is more or less concave throughout. Its least vertical diameter is 32 mm.

The anterior end of the zygomatic process slants upward and forward with a gentle curve and finally makes a sudden turn upward and backward. The corresponding emargination in the malar bone does not describe a similar curve, but passes, in its upper portion, with a beveled edge, behind (inside of) the edge of the zygomatic process. The sutures are entirely obliterated in the arch of the right side, but the left arch has been fractured accidentally, and the suture cracked open. However, even on the right side (Pl. I) the location of this suture may be seen as a line, from both sides of which the faces of the two bones slope in different directions.

There is a rough semicircular ridge on the inside of the zygomatic process, passing from its infero-anterior point to a point perpendicularly above the same. In front of this ridge is a broad shallow fossa extending over a considerable portion of the malar bone.

Leidy's description of the *malar process of the maxilla* in *M. jeffersoni* (*l.c.*, p. 9) applies also to *M. leidy*, except in the latter having the infra-orbital canals double, a horizontal septum dividing each into two canals, one immediately above the other. This *individual* presents, also, an asymmetry in these canals, for, whilst that of the right side has but a rudimentary septum forming a complete partition only for a short

distance, a little behind the middle of the canal, the septum in the canal of the left side is complete through its entire length, and is 6 mm. thick in the centre of its anterior border. The anterior orifices are vertically oval, that of the right side measuring 13.5×9 mm.; the upper orifice on the left side measuring 8×5 mm., and the lower, 11×9 mm.

Resting on the zygomatic process of the maxilla, the root of the *malar bone* projects outward, backward, and downward, its antero-posterior diameter being 12 mm., the intero-exterior 21.5 mm. in its narrowest place, about 12 mm. below the summit of the curve of the said process. About 9 mm. further down, on the interior side, is a tuberosity forming the superior termination of an area for muscular attachment. This area, 10 mm. wide and 41 mm. long, twists itself around the border of the bone, so that its lower end faces directly forward. It is divided by a low, median longitudinal ridge into two facets.

From the border, bearing this area, the external surface of the bone turns outward and backward, and at the same time expands both upward and downward; the anterior border of the upper expansion forms the exterior border of the orbit, and terminates about 5 cm. above the inferior orbital border in a postorbital protuberance; whilst the downward expansion is prolonged into a free *descending ramus*, terminating abruptly, 96 mm. below the inferior border of the orbit. A low ridge passes from the infero-posterior corner of this ramus, on its exterior face, diagonally upward and forward, dividing that face into two concave facets, of which the antero-inferior is triangular in form, the other somewhat rhomboidal. The inferior as well as the posterior borders of the ramus are attenuated to sharp edges; its anterior face is triangular, and by a sharp ridge set off from the exterior face; its interior face is smooth and convex.

Posterior to a line, which may be drawn from the postorbital protuberance of the malar bone to the posterior margin of the descending ramus, the exterior face of the bone bends more strongly backward, and the corresponding line on the interior face is the anterior margin of the broad shallow fossa which extends to the semicircular ridge near the distal end of the zygomatic process of the squamosal. The free postero-inferior margin of this laminar body forms a sharp edge, and, on the external face, bordering on this edge, is seen a semicordate muscular impression, pointed behind, oval in front, and reaching nearly half way towards the inferior margin of the orbit.

A line drawn from the postorbital protuberance of the malar to the nearest point of the zygomatic process of the squamosal, may be regarded as the base of the *ascending ramus* of the latter. Below this line the external face of the bone slopes down-

ward and forward; above the same line the ascending process slopes upward and inward. It also points strongly backward. Its free borders are nearly straight, except near the apex, where they suddenly converge, and near their bases, where the anterior border gently curves convexly upon the postorbital protuberance, whilst the posterior border makes a concave curve towards the superior margin of the zygomatic process. The internal face of the ramus is strongly convex.

The entire span of the zygomatic arch is 25 cm., from inion to the farthest point on the anteorbital margin, and 11.8 cm. from the inner curve of the zygomatic process of the squamosal to the inner curve of the corresponding process of the maxilla. The distance between the apices of the two rami of the malar is 18.4 cm.

Superior view.—One of the most obvious differences in the three skulls is presented by the divergence of the temporal ridges. A comparison of Plate II with Leidy's Plate II will tell this at a glance. The angle between these ridges is acute in the Owen specimen, but broadly obtuse in the other. But the Dickeson specimen has the same angle still more obtuse, and no specific value can therefore be attached to these differences.

Posterior view (Pl. IV, Fig. 2).—Here the differences are more important. In *M. jeffersoni* (l.c., Pl. VI, Fig. 3) the outline of the inion is semicircular; in *M. leidyi* it is decidedly polygonal, though with rounded corners. The upper portion of the inion is in *M. jeffersoni* flattened, and bordered below by a transverse crest. In *M. leidyi* the corresponding portion bulges out to form a broad tuberosity, bordered below by two transverse fossæ, one on each side of the vertical crest.

Foramen magnum is transversely oval, its horizontal and vertical diameters respectively 43 mm. and 34 mm. In *M. jeffersoni* this foramen is circular, its diameter 34 mm. ("16 lines," Leidy).

Anterior view.—In comparing Leidy's Pl. VI, Fig. 2, with our Pl. IV, Fig. 1, it should be remembered that the specimen figured by Leidy has the intermaxillaries preserved, which ours has not. Other differences are such that it is hard to tell what is of really specific importance or may be due to age or sex.

The nasal cavity.—The internal structure of the nose is much better preserved in our specimen than in either of the skulls described by Leidy. A brief description will therefore be in place here.

Behind the incisive foramen the anterior end of the hard palate is turned upward and slightly inclined backward between the alveolar walls of the canine molars, to a height of about 25 mm. Its upper edge is centrally produced in a triangular process with acuminate apex. A nasal crest of the maxillaries commencing about 65 mm. behind its anterior border, and resting on the median line of the floor of the cavity,

abuts on the front wall just described and participates in forming the apex of its triangular process.

The upper bony septum of the cavity is formed by a perpendicular lamina, 48 mm. high and 2 to 4 mm. thick in its anterior margin. This lamina, which extends 115 mm. backward, has its free edge grooved for the attachment of the cartilaginous septum. The distance between the antero-inferior corner of this lamina and the apex of the triangular process below is 26 mm. The anterior margins of the nasal bones project about 25 mm. beyond the perpendicular lamina. Attached to the antero-inferior margins of the nasals, and about 30 mm. behind their anterior margins, appear the anterior margins of the *ethmo-turbinals* as vertical laminæ, until in the postero-superior recesses of the cavity, they expand their convoluted portions.

The *maxillo-turbinals* are very large. Their anterior extremities show them to be borne on the lateral walls of the cavity, near the proximal extremity of the canine molars, and thence to extend both upward and downward. The upper portion bends around the alveole and bulges out externally, following, with a small interspace, the form of the wall of the cavity. The lower portion extends into the cavity between the maxillary wall and the nasal crest. The inner side facing the nasal septum is flattened. The vertical height of the whole maxillo-turbinal is at least 8 cm., the upper portion being the higher; the antero-posterior diameter is about 9 cm. At the anterior margin of its root on the maxillary wall is seen a circular foramen with raised borders, appearing as the projecting end of a tube.

Capacious air sinuses extend backward in the root of the pterygoid (Pl. III), and branch off from there forward into the alveolar wall of the maxilla.

Inferior view, and sections of the skull.—The distinctive characters of *M. leidy* are best expressed in its proportions. Leaving out measurements and plates from Leidy's "Memoir," his description would exactly fit to our specimen, as well. Perhaps the most striking peculiarity of the latter is the far lesser prominence (depth) of its maxillary portion. This will be most readily appreciated by comparing the sections, Pl. V, Figs. 1-6, which were constructed with great care, Figs. 1, 3 and 5 from the Kansas specimen, and Figs. 2, 4 and 6 from a plaster cast of the Owen specimen.

Sections 1 and 2 were taken vertically and longitudinally through the sagittal crest. The vertical distance between the base of the cranium and the most projecting point of the hard palate in the specimens measured, is respectively 34 mm. and 60 mm.

Sections 3 and 4 are transverse, nearly vertical, sections of the same specimens, immediately in front of their 2d molars and anteorbital margins.

Sections 5 and 6 are also transverse and vertical, passing through the anterior

borders of the *foramina rotunda* [the locations of these foramina are indicated by asterisks (**)], and thus at or near the narrowest portion of the cranium.

The pterygoid processes converge more rapidly forward in *M. jeffersoni* (*l.c.*, Pl. III) than in *M. leidyi* (Pl. III), their most approximated points in the former being just below the said foramina, but in the latter, at least 5 cm. more forward. Their roots bend more outwardly, their horizontal interior portions are narrower, and the anterior end of the basi-sphenoid, exposed to view between their inner margins, is broader in the line of the section in *M. jeffersoni* than in *M. leidyi*. The area between the root of the pterygoid process and the inferior border of the temporal fossa, in *M. jeffersoni*, overhangs the said process, sloping upward and outward about 30°, and extending as a plane in that direction about 3 cm., when it suddenly bends vertically upward, and finally makes a sudden turn inward and upward to its margin on the sagittal crest. The same surface in *M. leidyi* rises at once from *foramen rotundum* more than 60°, and curves gently up to the crest without any sudden bend. Sections 5 and 6 will show these differences plainly.

Dentition.—The left canine molar, as much as is left of it, as well as the alveoles of these molars, are but very slightly curved and are of uniform diameter. This species thus belongs to Group “B,” in Cope’s Synoptic Table (E. D. Cope: *Preliminary Report on the Vertebrata discovered in the Port Kennedy Bone Cave*, Am. Phil. Soc., Vol. xii, 1871, p. 85). The group comprises but two other known species, viz., *M. wheatleyi* Cope, and *M. dissimilis* Leidy. Cope makes the following distinction between the two:

“Molars triangular; canine molars less compressed—*M. wheatleyi*.”

“Last molar oval; canine molars more compressed—*M. dissimilis*.”

The third species of the group should be characterized thus:

Last molar ovato-triangular; the others quadrangular; canine molars less compressed—*M. leidyi*.

It might be added that the exterior dentine layer, in both of the former species, is thinnest at the bulge, whereas in *M. leidyi* it has its maximum thickness at the bulge.

The figures of the teeth (Pl. V, Figs. 7–9) are drawn with particular care. It should be remembered that the triturating surfaces are preserved only of the 1st and 2d molars in the left maxilla, and of the 2d, 3d (partly), and 4th in the right maxilla, and that the two 5th molars are broken off so high up as to expose their pulp cavities (compare Pl. III). Even regardless of this, the teeth are not perfectly symmetrical.

In naming this species for the venerable palæontologist, Prof. JOSEPH LEIDY, M.D., LL.D., of the University of Pennsylvania, I make but a small acknowledg-

ment of his admirable work on the osteology of the fossil Edentates—one of the numerous fields in which his master mind has illuminated the way on which humbler servants of Science endeavor to follow his lead.

Comparative Measurements of the Skulls of Megalonyx jeffersoni¹ and M. leidy.

	<i>M. jeffersoni.</i>		<i>M. leidy.</i>
	<i>Owen Spec.</i>	<i>Dickeson Spec.</i>	<i>Kansas Spec.</i>
Length of skull from occipital condyles to anterior margin of 1st molar alveoli	356	336	343
Length frominion to anterior margins of nasals.....	311	309
Length of temporal fossa to postorbital protuberance	197	197	199
Depth of temporal fossa in a straight line.....	102	114	108
Length of face from postorbital protuberance	119	112	115
Height of face to middle of hard palate ²	153	146	136
“ “ at anterior extremity.....	127	127	101 ³
Breadth “ “ “	95	95	83
“ “ at sides of 1st molar alveoli	114	114	101
“ “ at postorbital protuberances.....	127	138	123
Diameter of orifice of the nose.....	89	89	77
Breadth of intermaxillaries, across their centres.....	85 *	45 ³
Breadth of hard palate between 1st molars	60 †	40
Length of interval between 1st and 2d molars.....	50 †	40
Length of face from 1st to last molar alveolus	178	171	150
Length of maxilla from 2d to 5th molar alveoli, inclusive.....	95 †	95 *	80 §
Breadth of cranium at narrowest part of the temporal region	89	102	91
Length of sagittal crest.....	127	127	144 ⁴
Height ofinion from inferior margin of <i>foramen magnum</i>	110	110	107
Breadth ofinion at mastoid processes.....	159	165	165
Capacity of brain cavity, 448 cu. cm. This indicates the weight of the brain to have been 16 oz. (according to Owen's rule: <i>Comp. Anat. and Physiol. of Vertebrates</i> , Vol. iii, p. 144; the footnote).			

¹ According to Leidy (*l.c.* p. 13), unless otherwise stated. His measurements, in inches and lines, have here been reduced to millimetres.

² This measurement is taken in a vertical plane passing close in front of the anteorbital borders.

³ Although the intermaxillary bones are missing, the areas of their attachment to the maxilla are well marked.

⁴ The anterior terminus of this crest is determined somewhat arbitrarily, the parietal bones leaving a wide fissure between their margins, which gradually diverge and pass over into the ridges curving outward and forward to the postorbital protuberances.

* Measured on Leidy's plates.

† Measured on a plaster cast.

§ Estimated.

EXPLANATION OF THE PLATES.

Plate I.

Lateral view—two-thirds natural size.

Plate II.

Superior view—two-thirds natural size.

Plate III.

Inferior view—two-thirds natural size.

Plate IV.

Fig. 1. Anterior view—two-thirds natural size.

Fig. 2. Posterior view—two-thirds natural size.

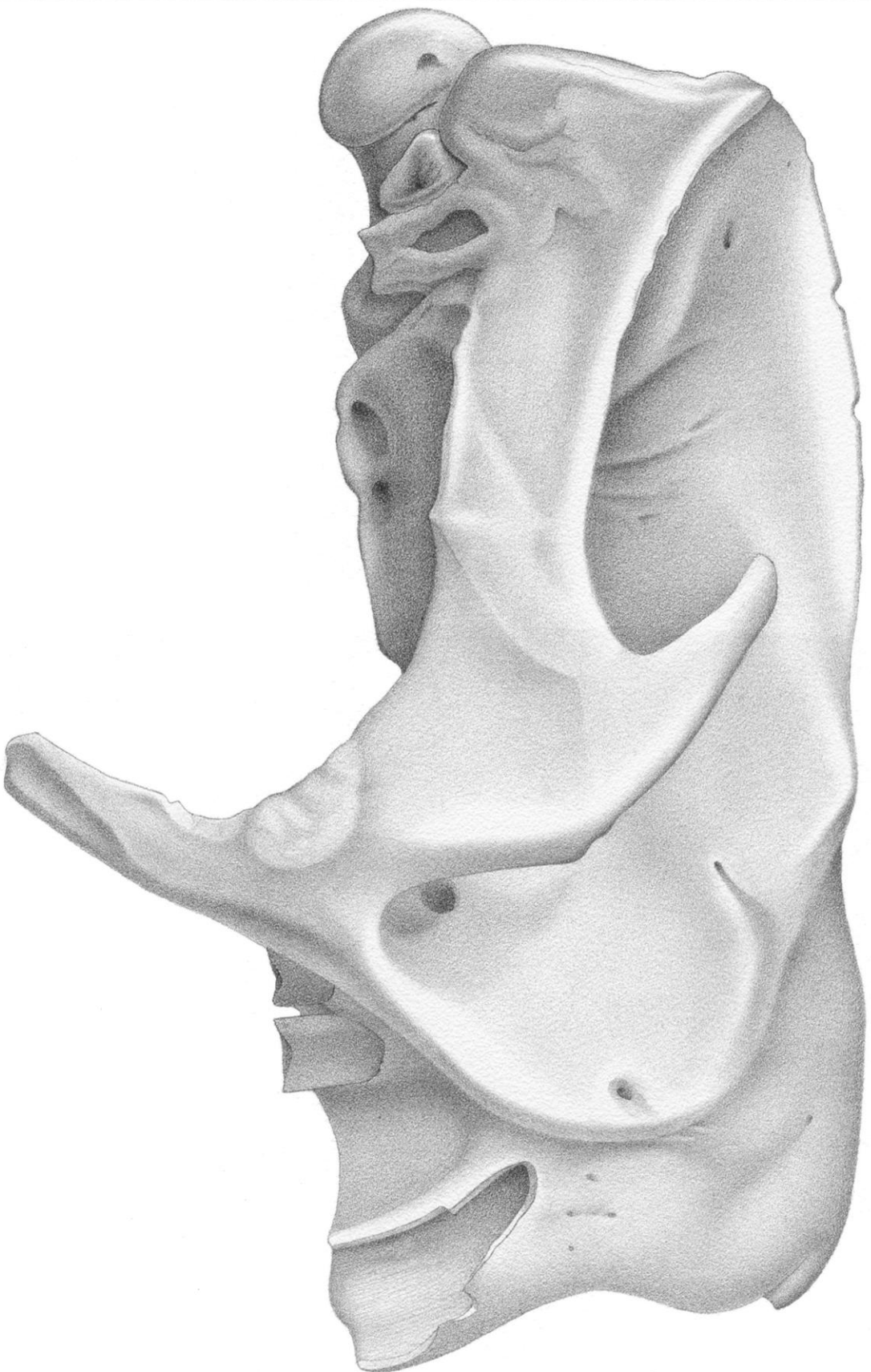
Plate V.

Figs. 1, 3 and 5. Sections of skull of *M. leidy* }
 Figs. 2, 4 and 6. Sections of skull of *M. jeffersoni* } (see page 7).

Fig. 7. Dentition—natural size, and arranged on the plate in natural position.

Figs. 8 and 9. Views of exterior side and triturating surface of left canine molar ; natural size.

P. S.—Prof. E. D. Cope, in letters to Prof. Udden, determined the teeth of *Equus major*, found in the same bed as this skull, and also determined the age of the formation as belonging to the *Equus* beds. He afterwards referred to the skull, in *Am. Nat.*, Vol. xxiii, p. 660, as “only found in the *Ticholeptus* formation of Kansas.” This was a *lapsus calami* which had escaped his notice until after the above was in type, and, at his request, it is hereby corrected. His figures, Pl. xxxi, were reproductions of three photographs made in Kansas. The photographer had placed the broken left canine-molar upside down in the right (the wrong) alveole.—J. L.



A. M. Westergren del.

G. Tholander lith.

W. Schlaechter, Stockholm, Sweden.

MEGALONYX LEIDYI Lindahl.

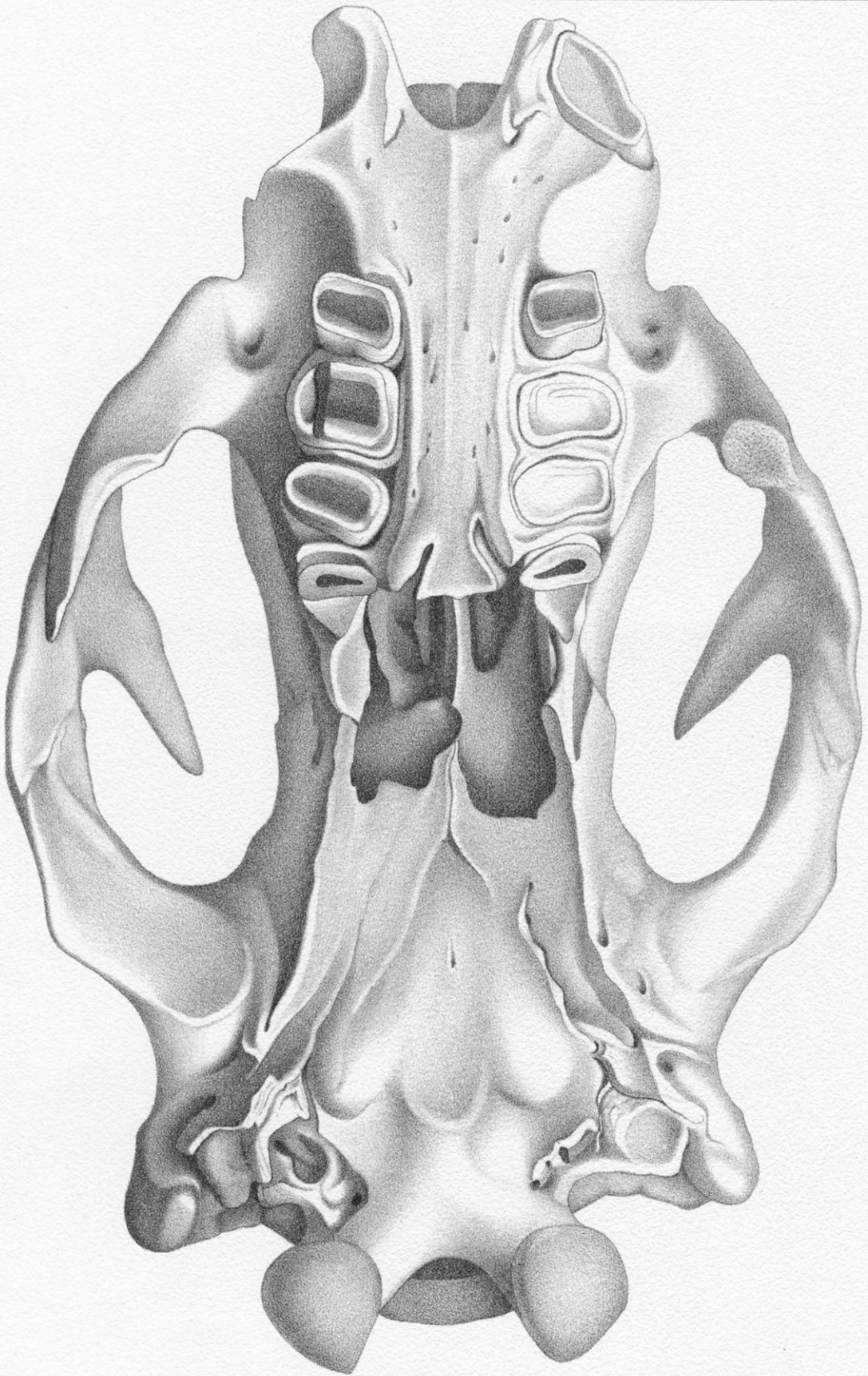


A.M. Westergren del.

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MEGALONYX LEIDYI Lindahl.



A. M. Westergren del.

G. Tholander lith.

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MEGALONYX LEIDYI Lindahl.

Fig. 1.

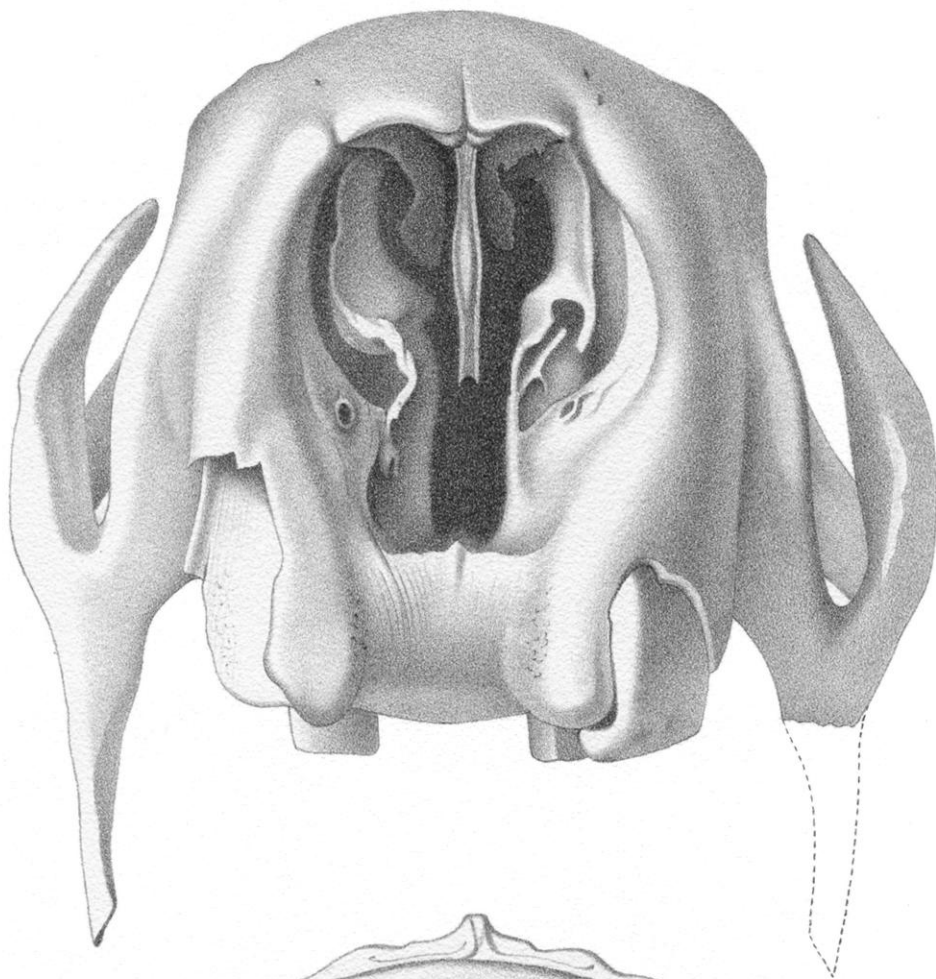
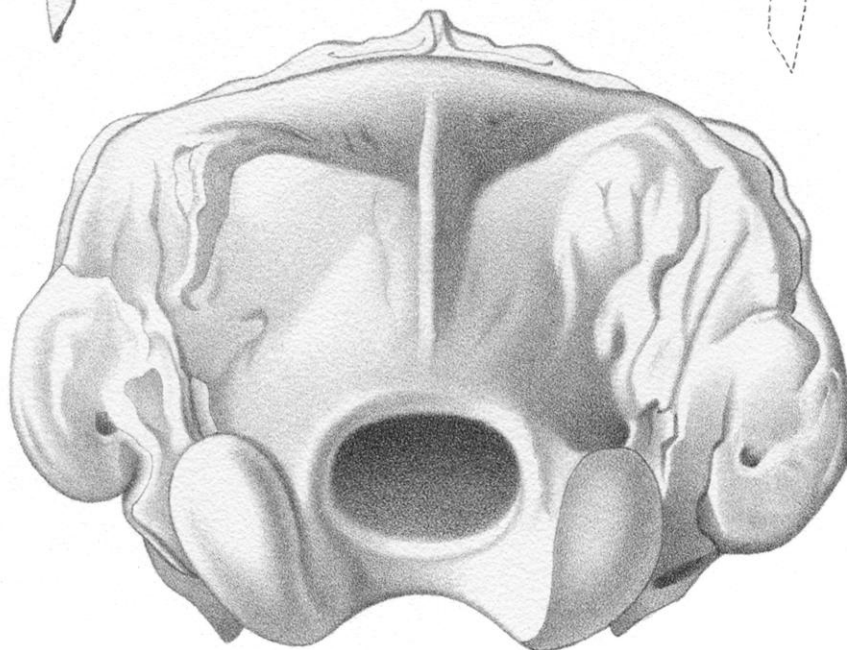


Fig. 2.



A. M. Westergren. del.

G. Tholander lith.

W. Schlachter. Stockholm, Sweden.

MEGALONYX LEIDYI Lindahl.

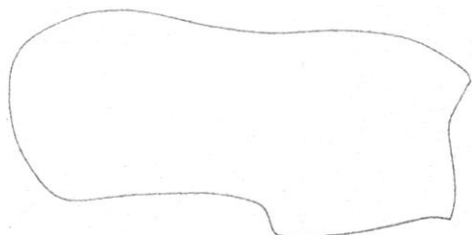


Fig. 1

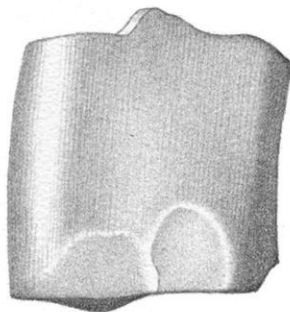


Fig. 8

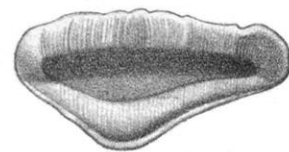


Fig. 9



Fig. 2

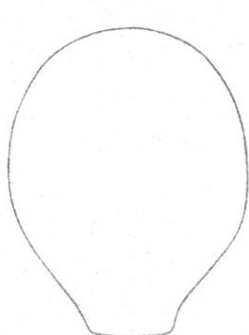


Fig. 3

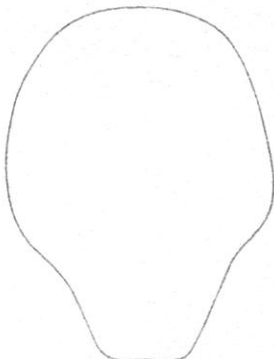


Fig. 4

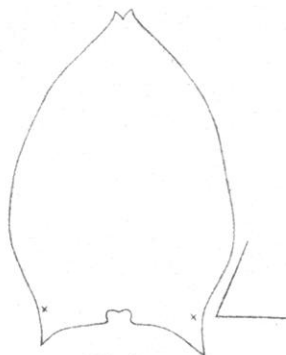


Fig. 5

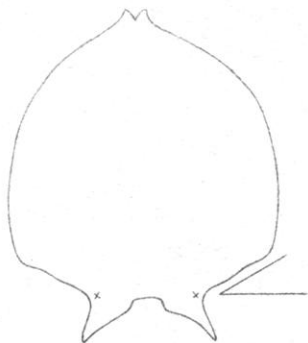


Fig. 6

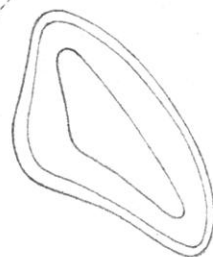
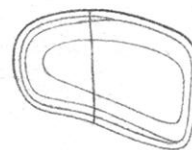


Fig. 7



A. M. Westergren. del.

G. Tholander. lith.

W. Schlachter, Stockholm, Sweden.